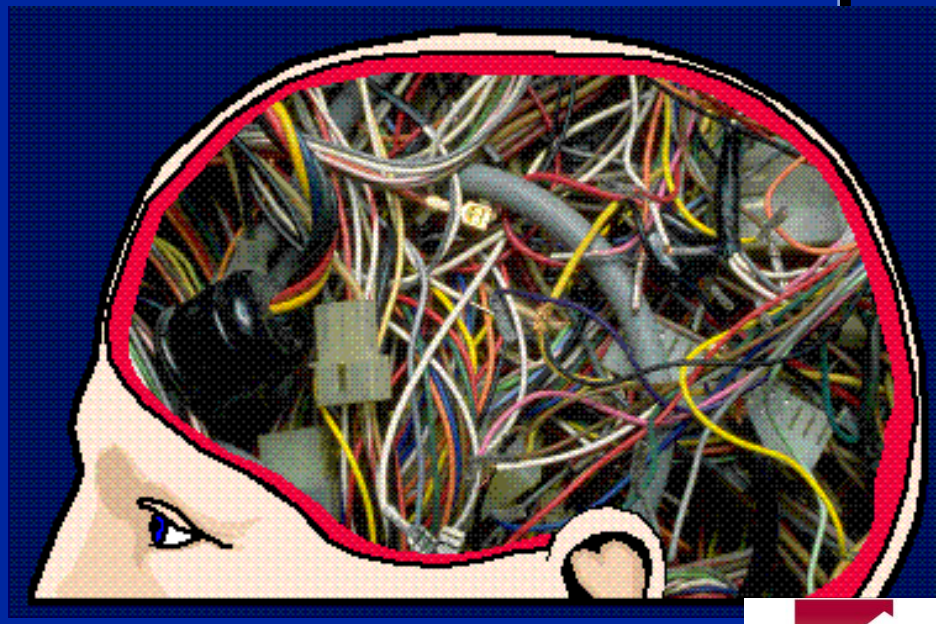
Ch 13: Central Nervous System
Part 1: The Brain p 378

- Discuss the organization of the brain, including the major structures and how they relate to one another
- Review the meninges of the spinal cord and brain, and integrate the formation and flow of CSF with this information.



Developed by
John Gallagher, MS, DVM

LAS POSITAS COLLEGE

Ventricles of the Brain p 381

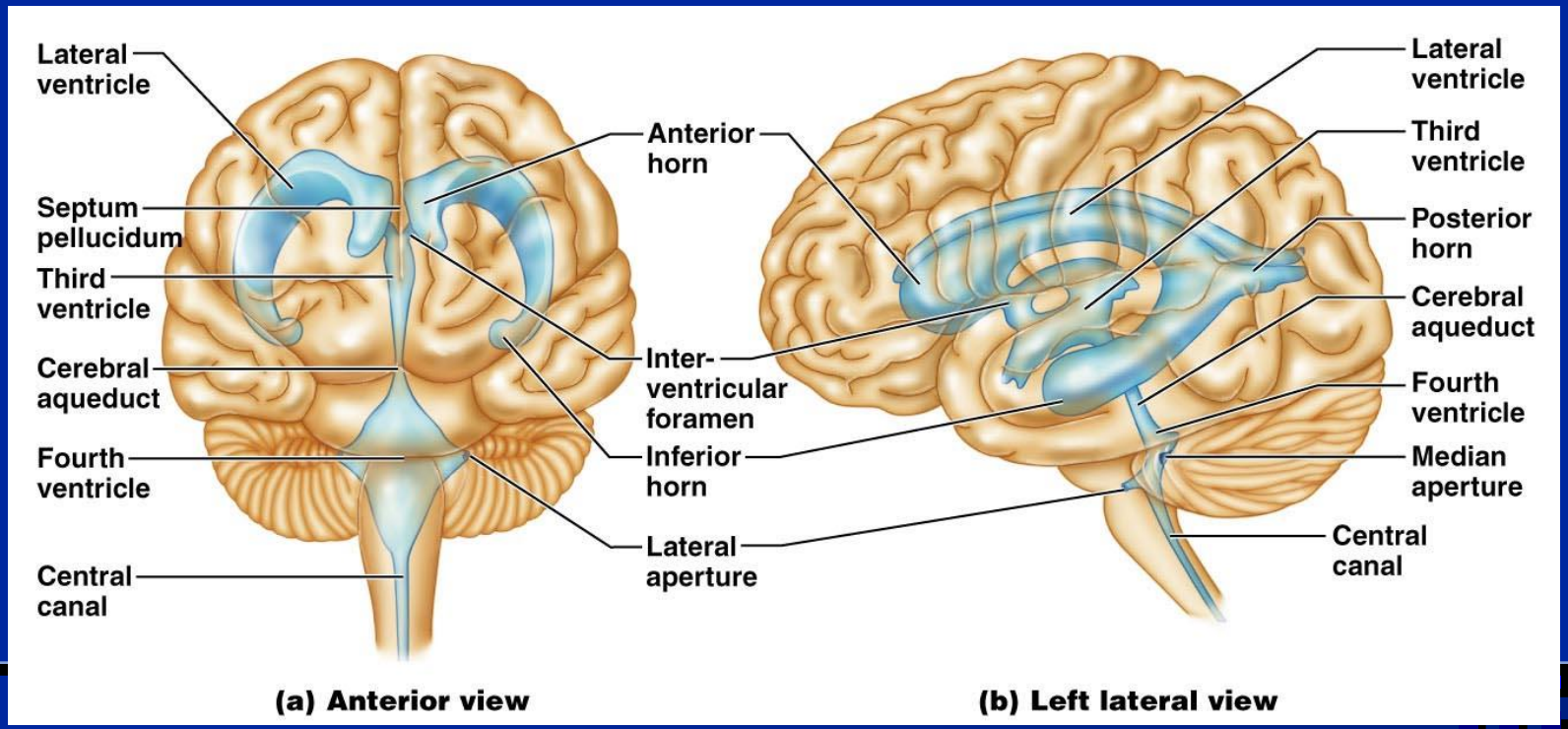
CSF filled chambers

Communicating with central canal of spinal cord

Lined by ependymal cells

Central Canal of Spinal Cord

Fig 13.9



Four Major Brain Subdivisions

1. **Brain Stem**
   a. Medulla oblongata
   b. Pons
   c. Midbrain
2. **Cerebellum**
3. **Diencephalon**
   a. Hypothalamus
   b. Thalamus
   c. Epithalamus
4. **Cerebral Hemispheres**
   AKA Cerebrum

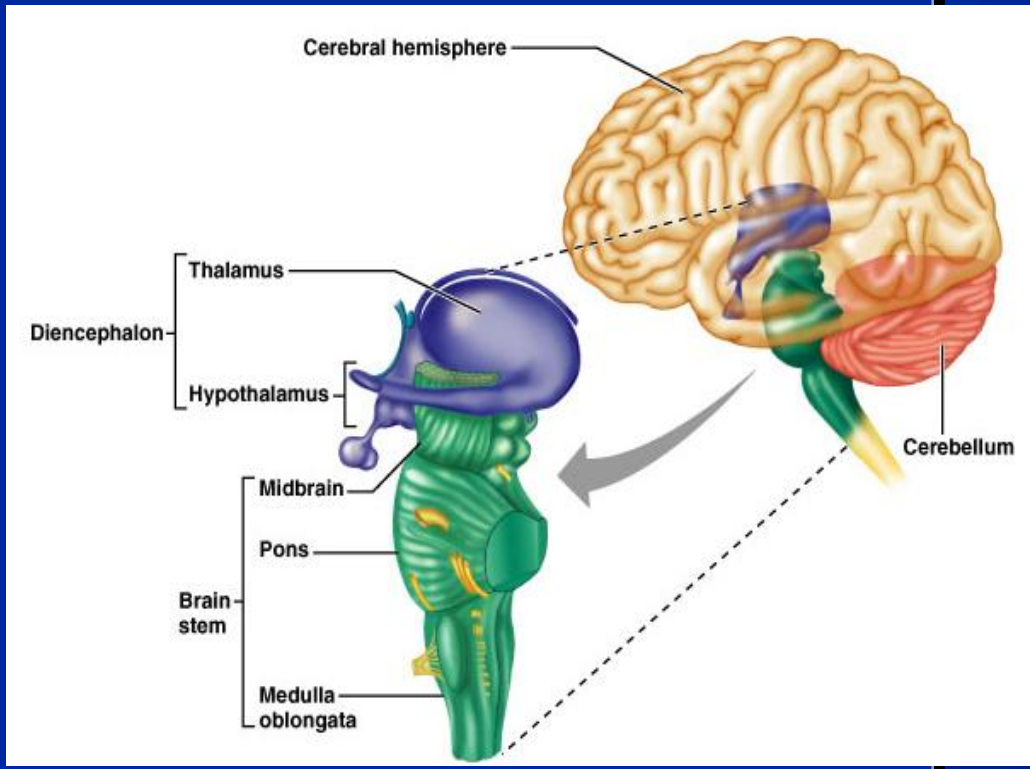
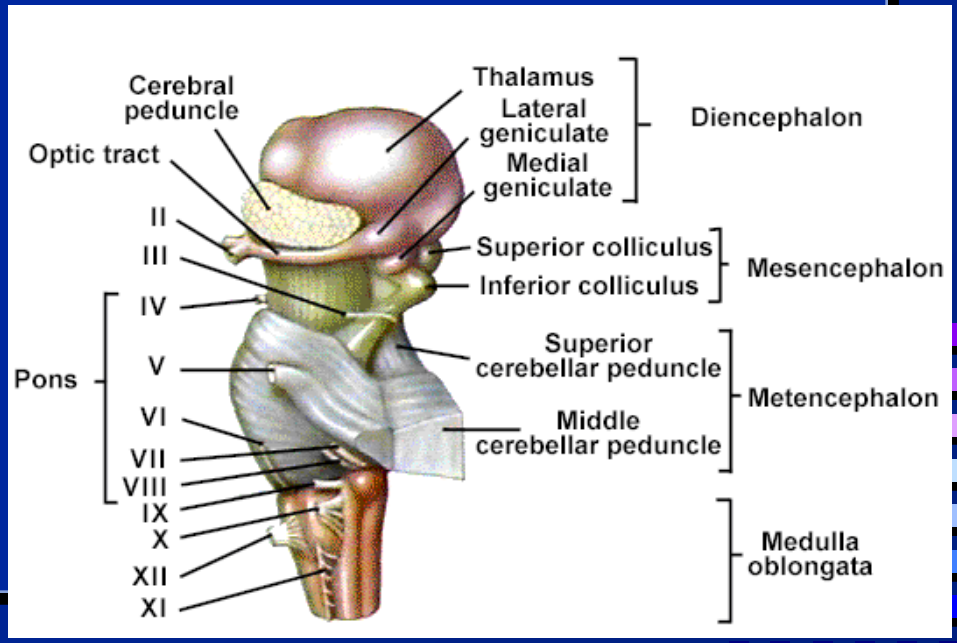


Fig 13.11

1) Brain stem

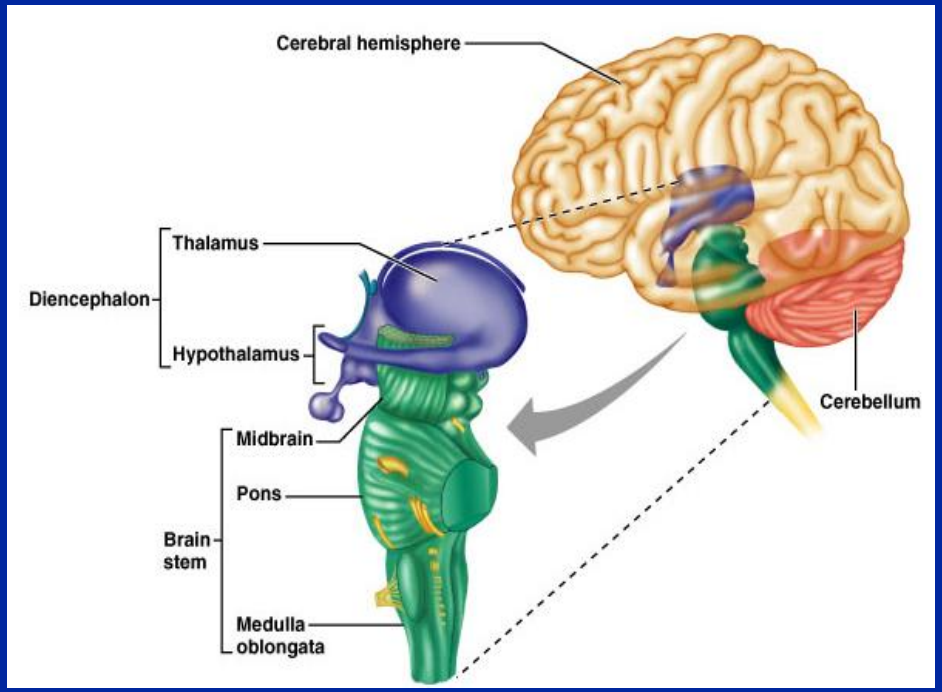
a. Medulla oblongata
b. Pons
c. Midbrain

- Location of autonomic nuclei involved in respiratory and cardiovascular control
- Relay stations for sensory and motor neurons
- Decussation



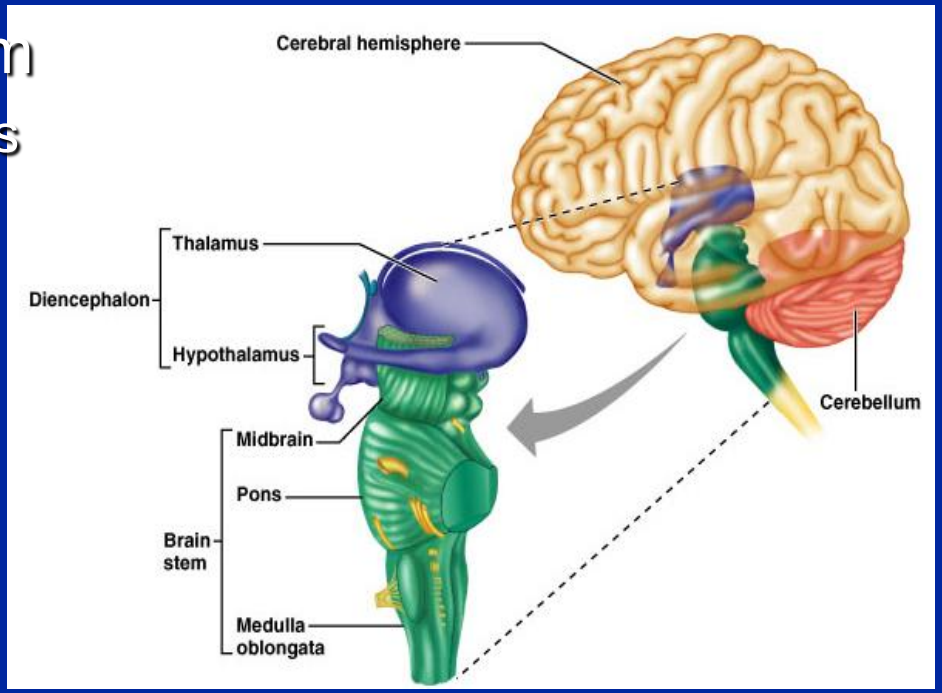
1a) Medulla oblongata

- Pyramids
  - Motor output to spinal cord
  - Decussation
- Reticular formation
  - Lower functions
  - Respiration, sleep, etc.
- Cranial nerves
  - VIII, IX, X, XI, XII



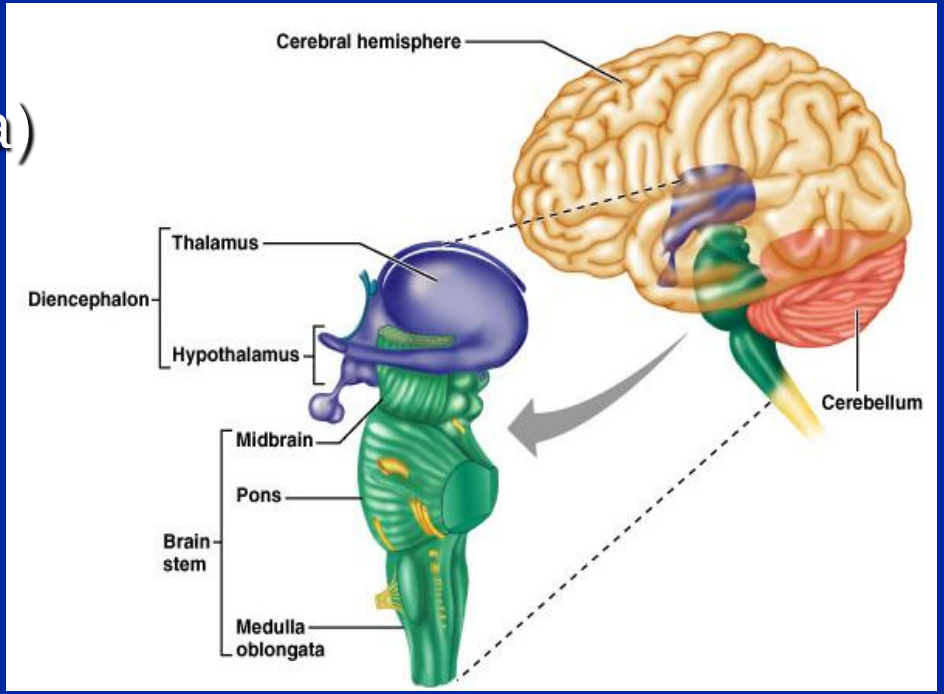
1b) Pons

- Pons = bridge
- Connects to cerebellum
  - Via cerebellar prduncles
- Cranial Nerves
  - V, VI, VII



1c) Midbrain

- Cerebral aqueduct
  - Old term: Aqueduct of Sylvius
- Several nuclei (ganglia)
  - Substantia nigra
- Sensory reflexes
  - Aural, visual



2) Cerebellum

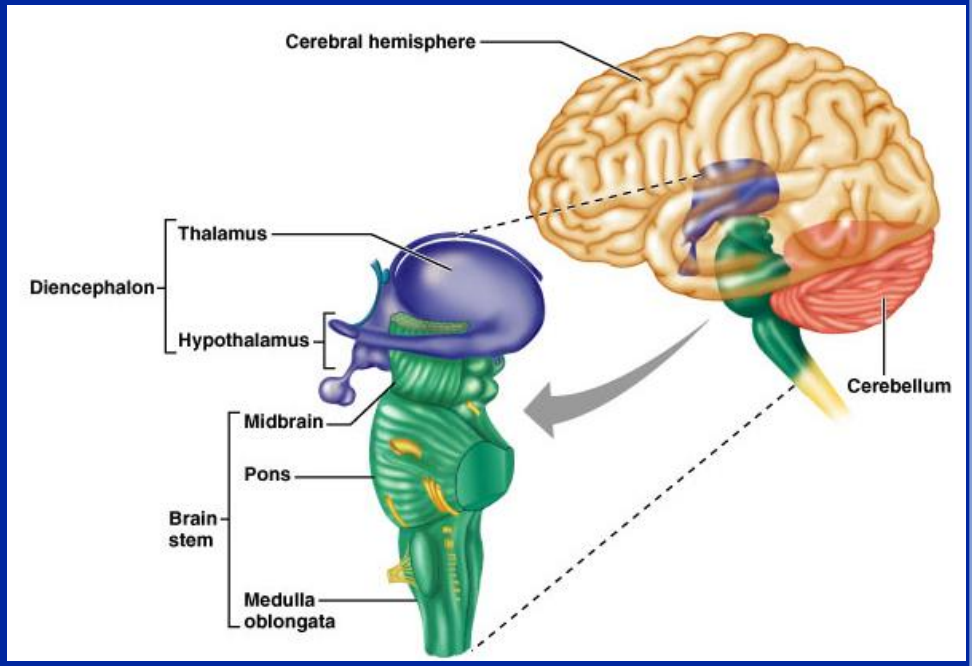
- Dorsal to the Pons
- Two hemispheres
  - Connected by the vermis
- Maintains posture and equilibrium
  - Smooths motor activities
  - Some cognitive function
- **Cortex - gray surface**
  - **Purkinje cells (p 354), axons of which become arbor vitae (white matter) in center**
    - » **Large cell bodies visible in gray matter of cerebellum**
    - » **Use GABA as NT**
    - » **Motor output from cerebellum**
- White matter: Arbor Vitae

3) Diencephalon p 390

3a. Hypothalamus

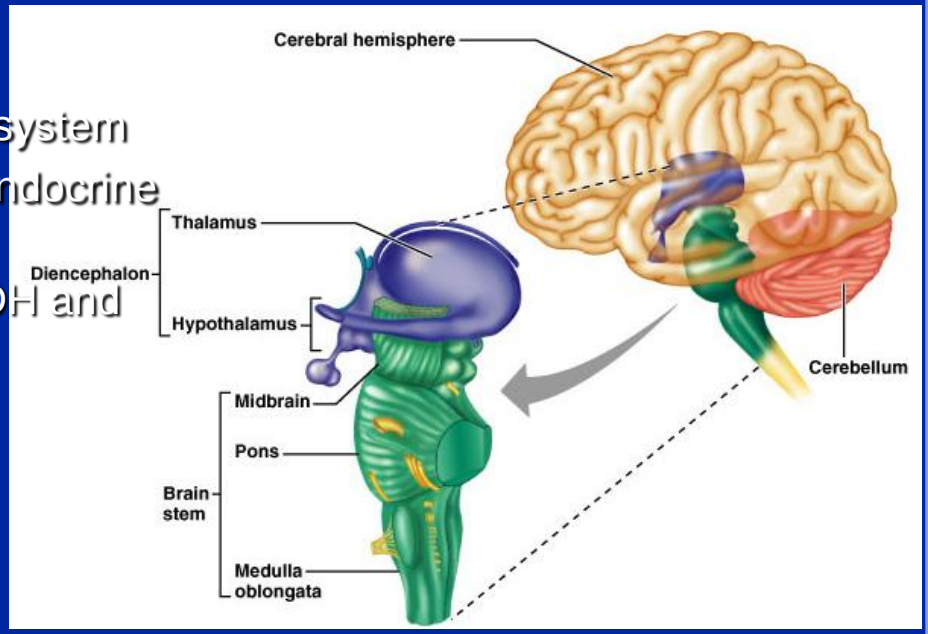
3b. Thalamus

3c. Epithalamus



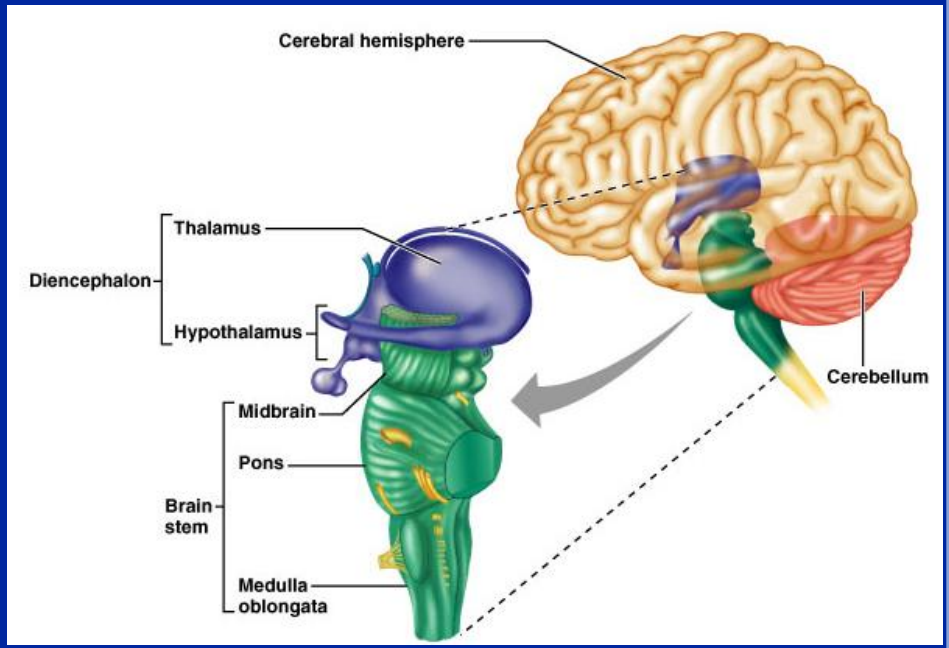
3a. Hypothalamus

- Just superior to optic chiasma
- Infundibulum - connects to pituitary gland
- *Some functions:*
  - Control of autonomic nervous system
  - Coordination of nervous and endocrine systems
  - Manufacture of hormones - ADH and oxytocin (Ch 17)



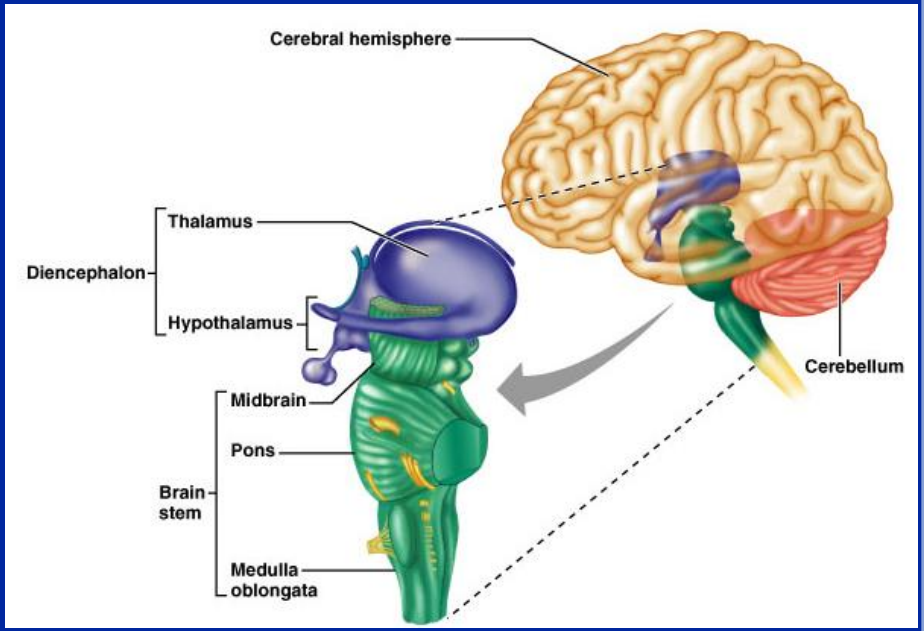
3b. Thalamus

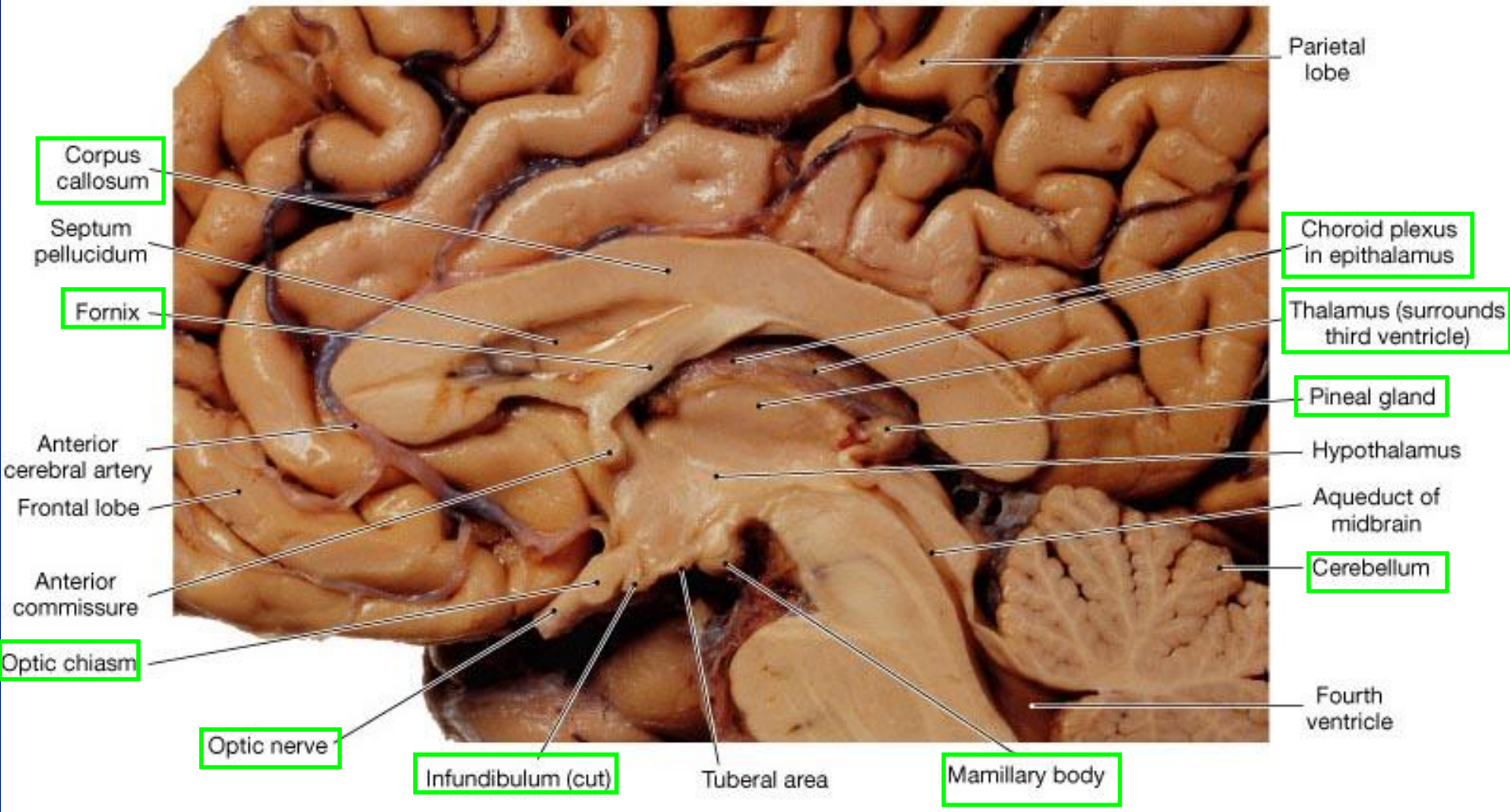
- (80% of diencephalon)
- Next to 3rd ventricle
- Communication with hemispheres



3c. Epithalamus

- Pineal gland - produces melatonin,
- sets diurnal cycles
- Choroid Plexus – produces CSF

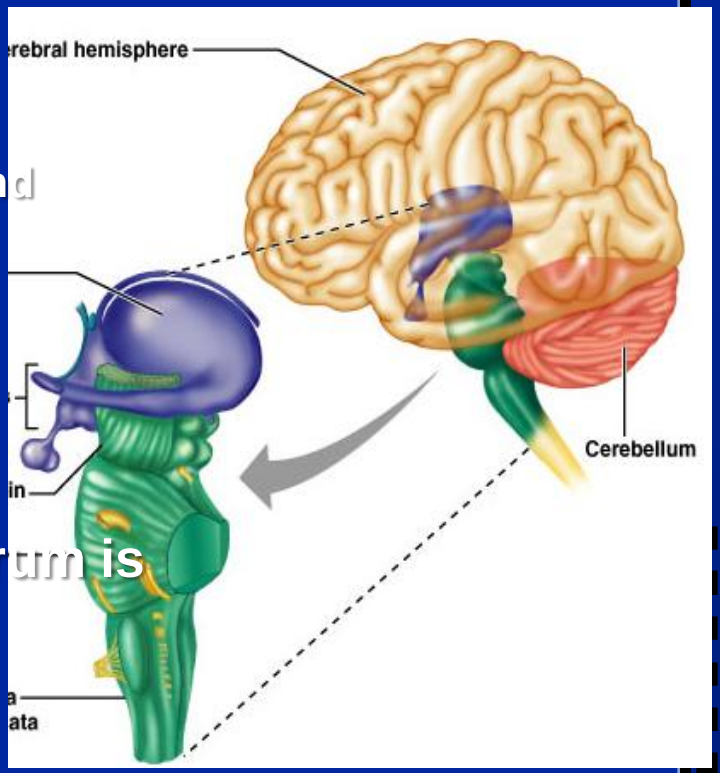




(a) Midsagittal section

4) Cerebrum (Telencephalon)

- 83% of total brain mass
- The right and left halves (cerebral hemispheres)
  - are separated by the **Longitudinal Fissure**
  - and connected by the **Corpus Callosum** and **Anterior Commissure**
  - are separated from the cerebellum by the transverse fissure
- **Sulcus** and **Gyrus**
  - **Central Sulcus**
- **Gray Matter** vs. **White Matter**
- The **cortex** (gray matter) of the cerebrum is the site of conscious thought



4) Cerebral Hemispheres, cont'd

- **. . have functional regions**
  - Sensory and motor areas
    - » e.g. Broca's area (speech)
  - Prefrontal Cortex (Cognitive functions)

- **. . . have some functional differences** (in spite of anatomical resemblance) → **Lateralization of cortical functioning**
  - **Right brain: artistic skill**
  - **Left Brain: math, logic**

- **. . . receive sensory information and generate commands for opposite side of body**
  - **Decussation of sensory input is in the spinal cord**
  - **Decussation of motor output is in the pyramids**

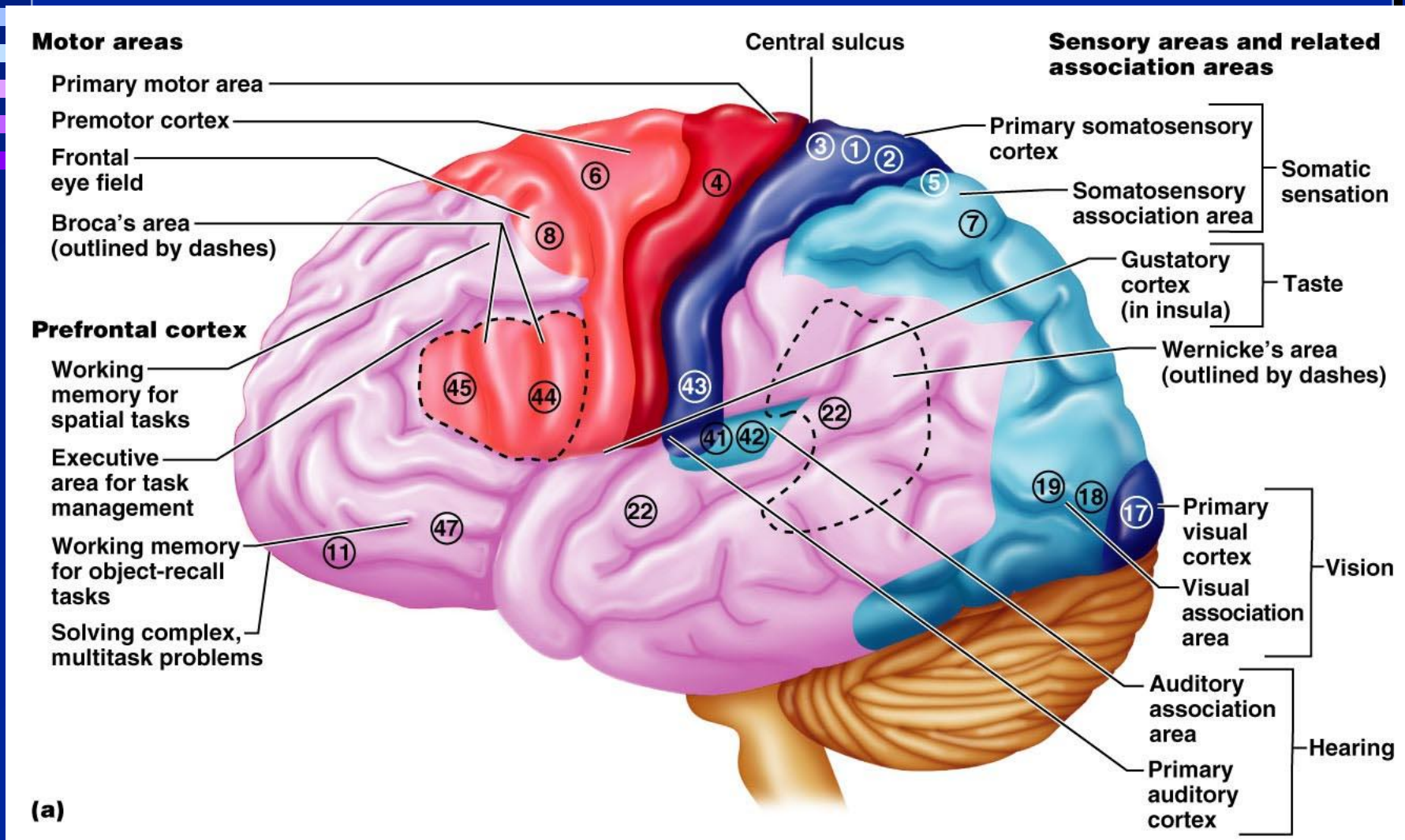


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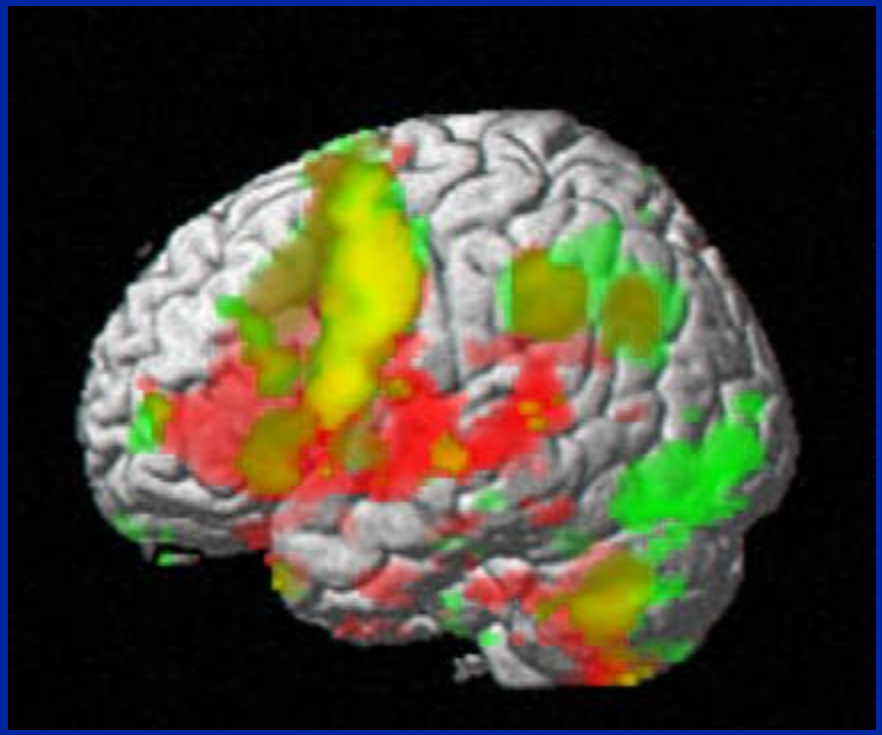
Fig 13.18

fMRI

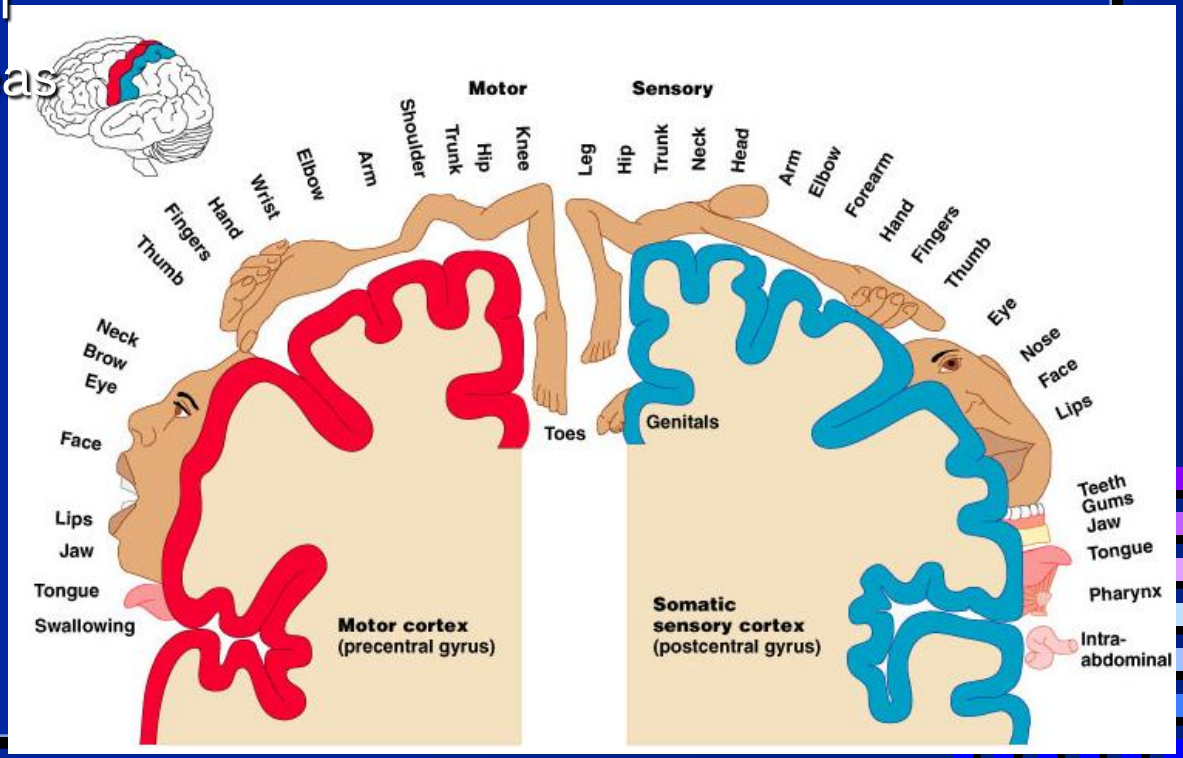
- An fMRI of the brain. Green areas were active while subjects remembered information presented visually. Red areas were active while they remembered information presented aurally. Yellow areas were active for both types.



4) Cerebrum, cont'd

Regions of the Cortex

- Lobes named after the bones of the calvarium
- Sensory vs. Motor Areas
  - Homunculus
- Gyrus and Sulcus
  - Central Sulcus

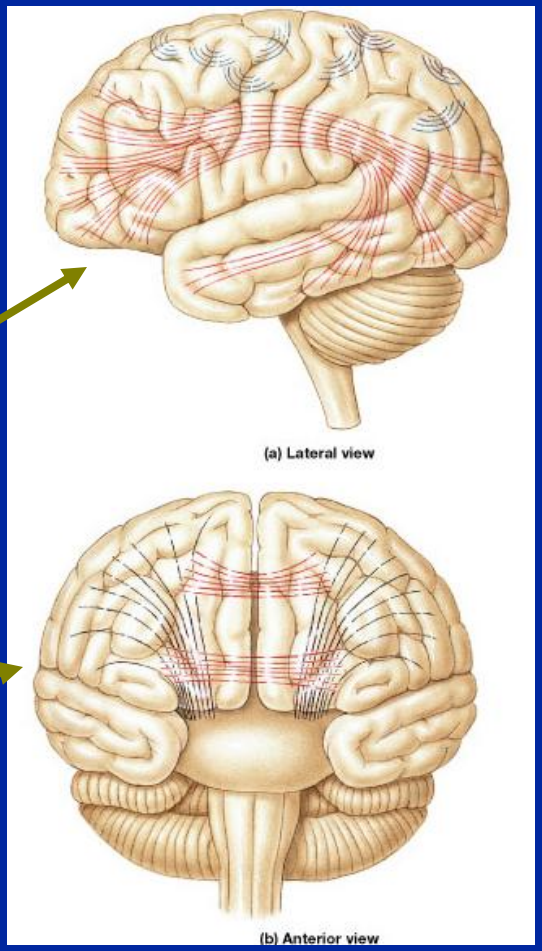


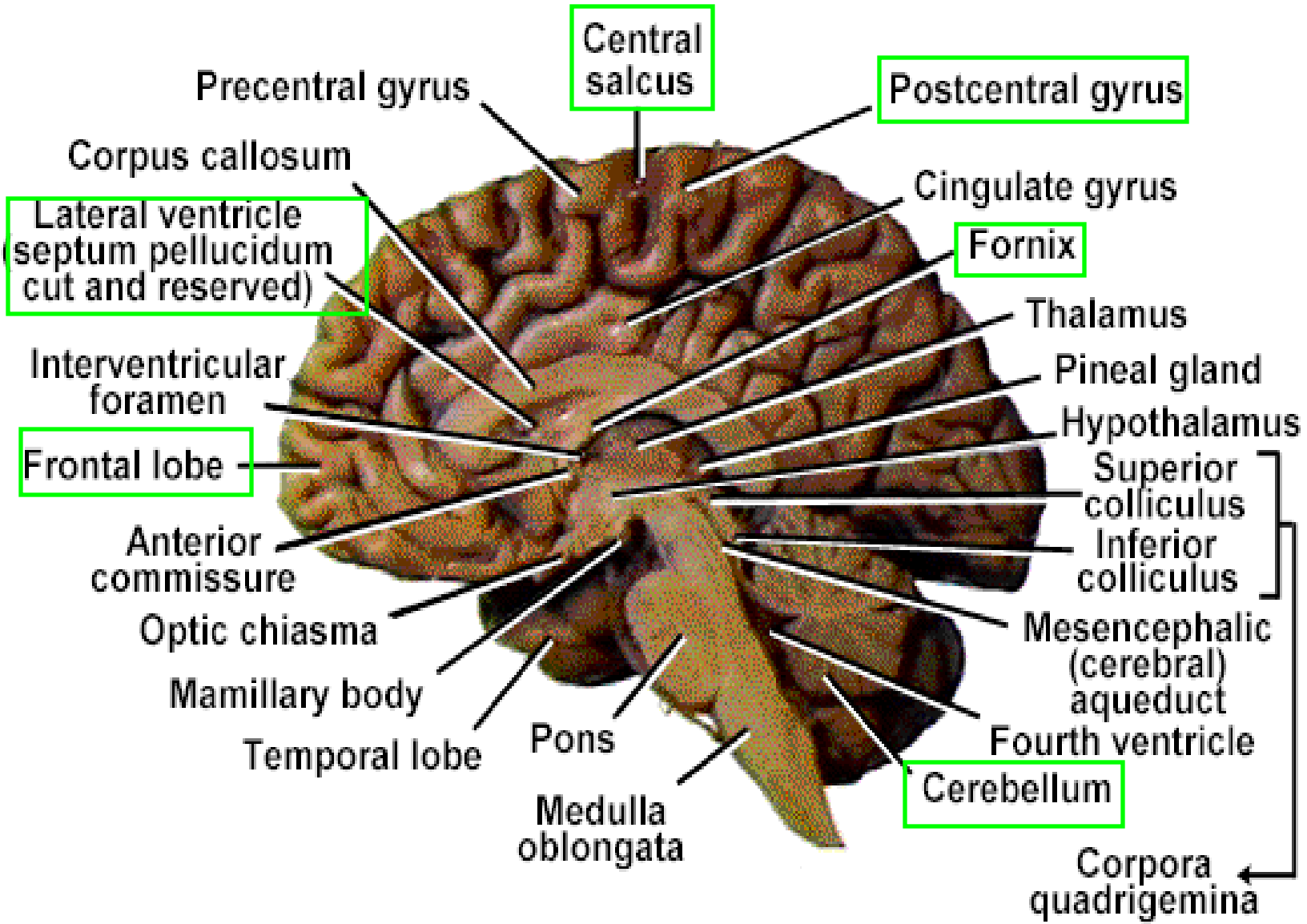
4) Cerebral Cortex and Central White Matter

Gray surface (cortex), 2-4 mm thick, is mostly neuron cell bodies with white tracts internally

Projection tracts (fibers) – connect more or less vertically

Association tracts (fibers) – connect one gyrus to another in the same hemisphere




Central salcus
Precentral gyrus
Postcentral gyrus
Corpus callosum
Cingulate gyrus
Lateral ventricle (septum pellucidum cut and reserved)
Fornix
Thalamus
Interventricular foramen
Pineal gland
Hypothalamus
Frontal lobe
Superior colliculus
Anterior commissure
Inferior colliculus
Optic chiasma
Mesencephalic (cerebral) aqueduct
Mamillary body
Fourth ventricle
Temporal lobe
Pons
Cerebellum
Medulla oblongata
Corpora quadrigemina

Basal Ganglia p 402

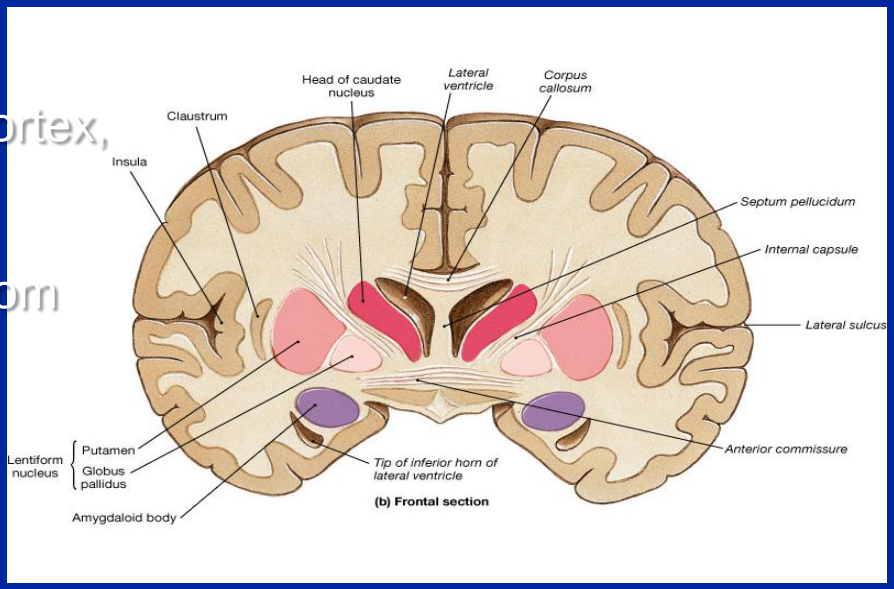
More proper term: basal nuclei

A collection of several nuclei

Gray matter deep to the cerebral cortex, below floor of lateral ventricles.

Function: modulate motor output from the cerebral cortex. Subconscious control of skeletal muscle tone and coordination of learned movement patterns.

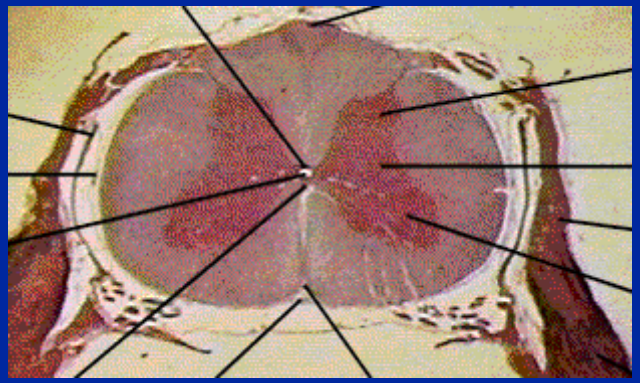
Parkinson's disease is caused by the loss of at least 80% of the dopaminergic neurons in basal nuclei and substantia nigra of the midbrain (resting tremor)

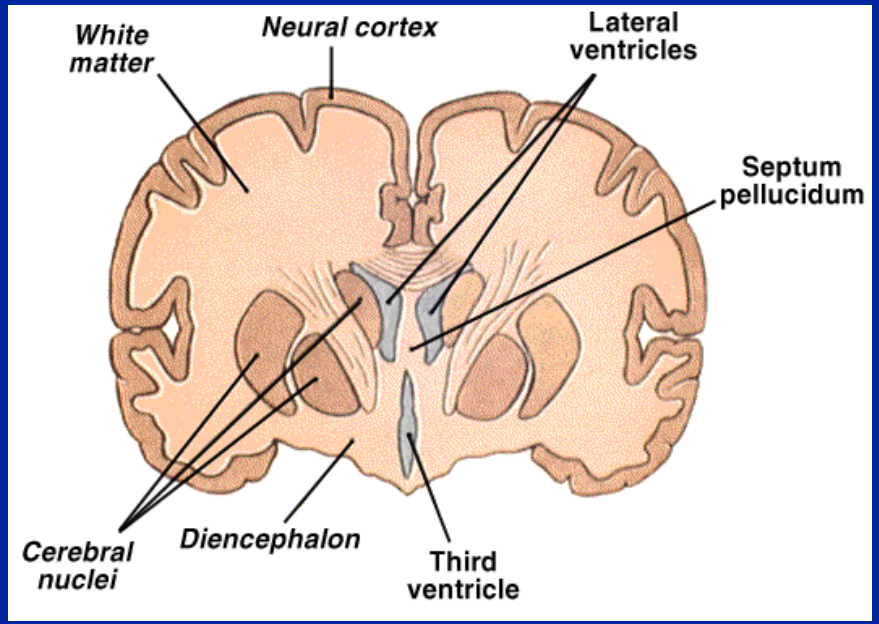


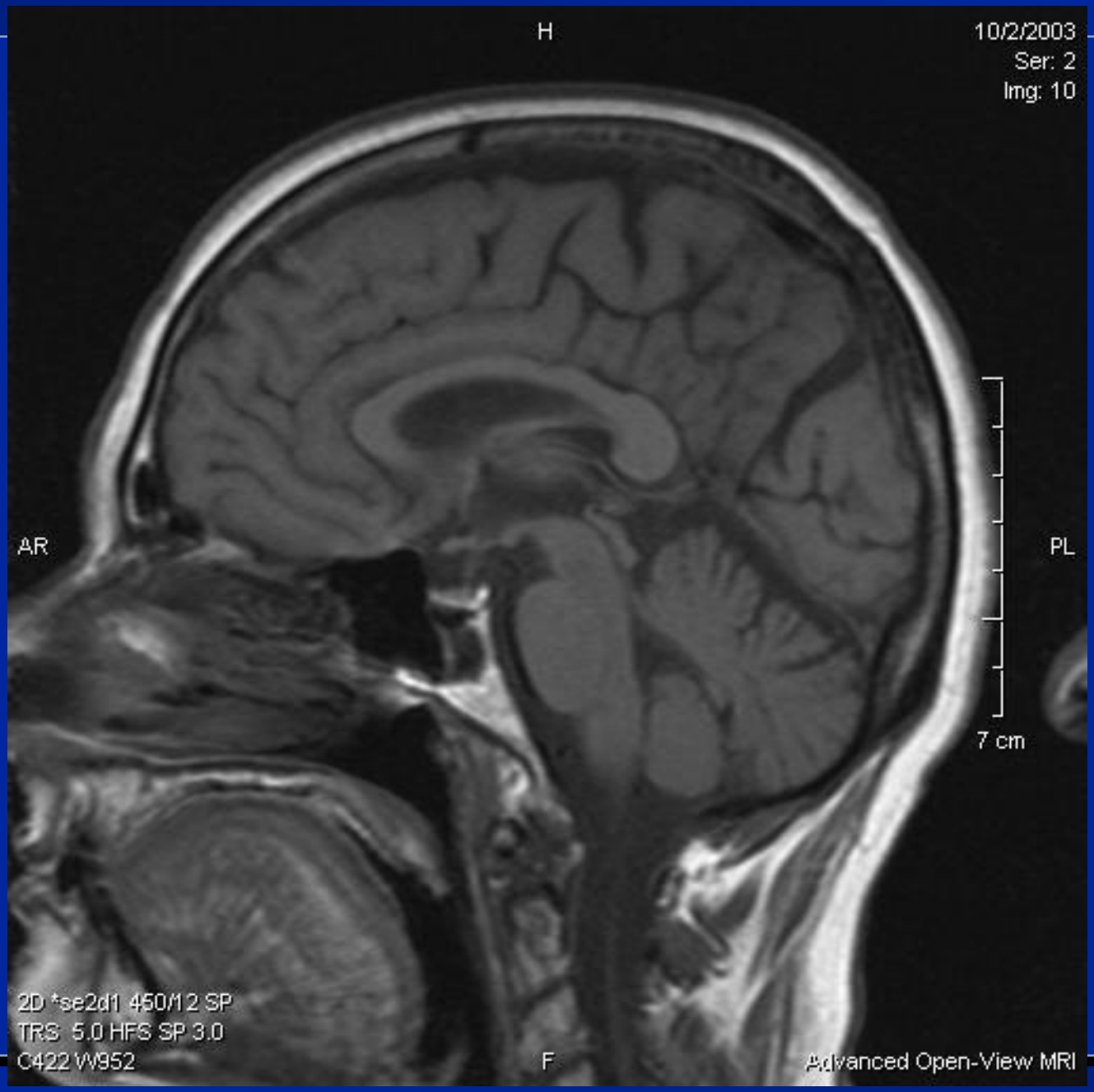
Gray & White Matter Organization

In **brain stem** similar to spinal cord (nuclei around ventricles, tracts on outside)

In **cerebrum** and **cerebellum**: white matter covered with layer of neural cortex (grey)



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